HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Stillaguamish Chum Program
Species or Hatchery Stock:	Stillaguamish Fall Chum
Agency/Operator:	Stillaguamish Tribe
Watershed and Region:	Stillaguamish Watershed Puget Sound ESU
Date Submitted:	June 31, 2000
Date Last Updated:	March 15, 2003

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Stillaguamish Chum Program

1.2) Species and population (or stock) under propagation, and ESA status.
State common and scientific names.

Currently, fall chum are propagated at the Harvey Creek Hatchery. This is a hatchery stock derived from native broodstock from Squire Creek, Aston Creek and Jim Creek tributaries within the Stillaguamish watershed. The chum stock status for the Stillaguamish is defined as healthy in the co-managers SASSI stock review document

1.3) Responsible organization and individuals
Indicate lead contact and on-site operations staff lead.
Name (and title): John Drotts, Natural Resources Director
On-site lead: Kip Killebrew, Enhancement Biologist
Agency or Tribe: Stillaguamish Tribe
Address: P.O. Box 277, Arlington, WA. 98223
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360-435-8770
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Email: jdrotts@stillaguamish.nsn.us
k.killeb@verizon.net

Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

The chum program is operated exclusively by the Stillaguamish Tribe. The Northwest Indian Fisheries Commission provides technical support for harvest and fish health issues. The Washington State Department of Fish and Wildlife is a co-manager of Stillaguamish River natural chum stocks.

1.4) Funding source, staffing level, and annual hatchery program operational costs.

Bureau of Indian Affairs 638 Funding-$105,000; Hatchery staff include an enhancement biologist, hatchery manager, fisheries technician and operations support person.

1.5) Location(s) of hatchery and associated facilities.
Include name of stream, river kilometer location, basin name, and state. Also include watershed code (e.g. WRIA number), regional mark processing center code, or other sufficient information for GIS entry. See "Instruction E" for guidance in responding.

The following facilities are located within the Stillaguamish watershed (WRIA 05):

Stillaguamish Tribe's Harvey Creek Hatchery located 2 miles upstream of the mouth of Harvey/Armstrong Creek (WRIA 05.0126), which is located 15.3 miles upstream of the mouth of the Stillaguamish main stem (05.0001).

Snohomish County Dept. of Corrections Indian Ridge chum egg box and rearing tank located approximately 8 miles upstream of the mouth of Jim Creek (05.0322) which is a tributary to the South Fork Stillaguamish.

1.6) Type of program.

Define as either: Integrated Recovery; Integrated Harvest; Isolated Recovery; or Isolated Harvest (see Attachment 1 - Definitions" section for guidance).

The Stillaguamish chum program is classified as an Integrated Education Program.

1.7) Purpose (Goal) of program.

Define as either: Augmentation, Mitigation, Restoration, Preservation/Conservation, or Research (for Columbia Basin programs, use NPPC document 99-15 for guidance in providing these definitions of "Purpose"). Provide a one sentence statement of the goal of the program, consistent with the term selected and the response to Section 1.6. Example: "The goal of this program is the restoration of spring chinook salmon in the White River using the indigenous stock".

The goal of this program is to use a native derived hatchery stock of chum salmon for the purpose of having adult chum returns for a school educational program. Each year 600 to 1000 students come from schools within the watershed to the hatchery to learn about salmon life histories, habitat and hatchery activities. Chum returning during November and December works best for the teachers in terms of scheduling. Chinook do not return to Harvey Creek hatchery and only limited numbers of coho return earlier in the season.

At the recommendation of the HSRG, this program has been changed from an integrated harvest program to an integrated education program and reduced in size from a release of 600, 000 fry to 200,000 fry.

1.8) Justification for the program.

Indicate how the hatchery program will enhance or benefit the survival of the listed natural population (integrated or isolated recovery programs), or how the program will be operated to provide fish for harvest while minimizing adverse effects on listed fish (integrated or isolated harvest programs).

The integrated education program will utilized wild origin hatchery stock with frequent

additions of wild chum broodstock to maintain the genetic similiarity of the hatchery fish to those in the wild. The program is small enough to have a minimal impact on the returning wild fish.

The hatchery program is located on a lower main stem tributary that has not had historic chum usage and the last documented use of the watershed by fall chinook was in the early 1970's. The historic natural use of chinook in the Harvey/Armstrong watershed is confounded by extensive plantings within the Harvey/Armstrong watershed of hatchery origin chinook from outside the Stillaguamish basin.

The rearing and release of chum from this facility will not significantly impact listed chinook spawning in the North and South Forks of the Stillaguamish.

1.9) List of program "Performance Standards".

"Performance Standards" are designed to achieve the program goal/purpose, and are generally measurable, realistic, and time specific. The NPPC "Artificial Production Review" document attached with the instructions for completing the HGMP presents a list of draft "Performance Standards" as examples of standards that could be applied for a hatchery program. If an ESU-wide hatchery plan including your hatchery program is available, use the performance standard list already compiled.

Example: " (1) Conserve the genetic and life history diversity of Upper Columbia River spring chinook populations through a 12 year duration captive broodstock program; (2) Augment, restore and create viable naturally spawning populations using supplementation and reintroduction strategies; (3) Provide fish to satisfy legally mandated harvest in a manner which minimizes the risk of adverse effects to listed wild populations; (4)....".

Please refer to Appendix A.

1.10) List of program "Performance Indicators", designated by "benefits" and "risks."

"Performance Indicators" determine the degree that program standards have been achieved, and indicate the specific parameters to be monitored and evaluated. Adequate monitoring and evaluation must exist to detect and evaluate the success of the hatchery program and any risks to or impairment of recovery of affected, listed fish populations.

The NPPC "Artificial Production Review" document referenced above presents a list of draft "Performance Indicators" that, when linked with the appropriate performance standard, stand as examples of indicators that could be applied for the hatchery program. If an ESU-wide hatchery plan is available, use the performance indicator list already compiled. Essential 'Performance Indicators" that should be included are monitoring and evaluation of overall fishery contribution and survival rates, stray rates,

and divergence of hatchery fish morphological and behavioral characteristics from natural populations.

The list of "Performance Indicators" should be separated into two categories: "benefits" that the hatchery program will provide to the listed species, or in meeting harvest objectives while protecting listed species; and "risks" to listed fish that may be posed by the hatchery program, including indicators that respond to uncertainties regarding program effects associated with a lack of data.

Please refer to Appendix A.

1.10.1) "Performance Indicators" addressing benefits.
(e.g. "*Evaluate smolt-to-adult return rates for program fish to harvest, hatchery broodstock, and natural spawning.*").

Please refer to Appendix A.

1.10.2) "Performance Indicators" addressing risks.
(*e.g. "Evaluate predation effects on listed fish resulting from hatchery fish releases."*).

Please refer to Appendix A.

1.11) Expected size of program.

In responding to the two elements below, take into account the potential for increased fish production that may result from increased fish survival rates effected by improvements in hatchery rearing methods, or in the productivity of fish habitat.

1.11.1) Proposed annual broodstock collection level (maximum number of adult fish).

There would be chum broodstocking occurring in the Squire, Aston and Jim Creek watersheds to provide periodic inputs of native spawners for the purpose of maintaining the genetic similarity of the hatchery stock to the existing wild stock.

Broodstocking would typically occur after all chinook spawning is complete within these specific watersheds.

Up to 20% of the adult broodstock for the Harvey Creek chum program will be captured from Squire and Aston Creeks. 100% of the broodstock for the Jim Creek Indian Ridge egg box will be captured from Siberia and Jim Creek.

Collections of hatchery broodstock occur at the adult trap at Harvey Creek Hatchery and

annual collections will not exceed 300 per year. No chinook have ever been captured in the adult trap during the chum broodstocking period.

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location. (*Use standardized life stage definitions by species presented in* Attachment 2).

Life Stage	Release Location	Annual Release Level
Eyed Eggs	Church Creek and Jim Creek	50,000
Unfed Fry		
Fry	Harvey Creek Hatchery and tribs within the watershed.	200,000
Fingerling		
Yearling		

1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data. *Provide estimated smolt-to-adult survival rate, total adult production number, and escapement number (to the hatchery and natural areas) data available for the most recent twelve years (roughly three fish generations), or for the number of years of available and dependable information. Indicate program goals for these parameters*

Broodyear	River Escapement	Recruits/Spawner	Hatchery Return Level
1986	90,623	1.49	1000
1987	29,291	1.08	59
1988	65,676	1.35	875
1989	6,499		74
1990	33,423		511
1991	9,200		50
1992	36,372		309
1993	10,524		86
1994	137,854		500
1995	19,472		450
1996	97,550		700
1997	2,908		60
1998	131,514		561
1999	36,287		564

1.13) **Date program started (years in operation), or is expected to start.**

The chum hatchery program began with wild broodstocking in 1978 and will continue as an integrated hatchery program into the future. The program has been scaled back from an integrated education program for the foreseeable future.

1.14) Expected duration of program.

The program is expected to continue indefinitely.

1.15) Watersheds targeted by program.
Include WRIA or similar stream identification number for desired watershed of return

The Stillaguamish watershed (WRIA 05) is the targeted watershed for this program.

1.15) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

No alternatives have been considered for this program. This is an integrated education program designed to provide adult chum returns for educational purposes.

SECTION 2. PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS.

2.1) List all ESA permits or authorizations in hand for the hatchery program.

A Section 7 or 4(d) Exemption is anticipated for the chinook US/Canada Indicator and Natural Stock Restoration Program currently under propagation at the Harvey Creek Hatchery.

2.2) Provide descriptions, status, and projected take actions and levels for ESA-listed natural populations in the target area.

2.2.1) Description of ESA-listed salmonid population(s) affected by the program.
Include information describing: adult age class structure, sex ratio, size range,migrational timing, spawning range, and spawn timing; and juvenile life history strategy, including smolt emigration timing. Emphasize spatial and temporal distribution relative to hatchery fish release locations and weir sites

- **Identify the ESA-listed population(s) that will be directly affected by the program.** *(Includes listed fish used in supplementation programs or other programs that involve integration of a listed natural population. Identify the natural population targeted for integration).*

  There are no ESA-listed populations that will be directly affected by this chum hatchery program.

- Identify the ESA-listed population(s) that may be incidentally affected by the

program.
(Includes ESA-listed fish in target hatchery fish release, adult return, and broodstock collection areas).

ESA-listed populations of bull trout and chinook salmon may be incidentally affected by the chum program through interactions occurring during the release period for chum and during the harvest of returning hatchery chum fish.

2.2.2) Status of ESA-listed salmonid population(s) affected by the program.

- Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds (*see definitions in "Attachment 1").*

- **Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.**
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  Please refer to the Hatchery Genetic Management Plan for Chinook for this information.

- **Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.** *(Include estimates of juvenile habitat seeding relative to capacity or natural fish densities, if available).*

  Please refer to the Hatchery Genetic Management Plan for Chinook for this information.

- **Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.**

  Please refer to the Hatchery Genetic Management Plan for Chinook for this information.

2.2.3) Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of listed fish in the target area, and provide estimated annual levels of take *(see "Attachment 1" for definition of "take")***.**

- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

(*e.g. "Broodstock collection directed at sockeye salmon has a "high" potential to take listed spring chinook salmon, through migrational delay, capture, handling, and upstream release, during trap operation at Tumwater Falls Dam between July 1 and October 15. Trapping and handling devices and methods may lead to injury to listed fish through descaling, delayed migration and spawning, or delayed mortality as a result of injury or increased susceptibility to predation*").

Broodstock collection of adult chum on Squire, Aston and Jim Creeks has a very low potential to take later spawning chinook. No chinook have been seen or captured during the chum broodstocking period on these tributaries.

There is a potential for the take of listed bull trout and chinook fry / smolts associated with the release of hatchery chum fry. Several researchers have documented the concentration of predators and increased predation rates during spring hatchery releases of salmon. Hatchery chum salmon are typically released in April before the peak outmigration of natural chinook and prior to the volitional release of program chinook.

-Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken, and observed injury or mortality levels for listed fish.

Both bull trout and chinook have just been recently listed, so there have been no past takes of either of these species. There have been no known mortalities of either chinook or bull trout as a result of running the chum hatchery program.

- **Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).**
*Complete the appended "take table" (**Table 1**) for this purpose. Provide a range of potential take numbers to account for alternate or "worst case" scenarios.*

- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.
(*e.g. "The number of days that steelhead are trapped at Priest Rapids Dam will be reduced if the total mortality of handled fish is projected in season to exceed the 1988-99 maximum observed level of 100 fish."*)

Harvest management plans are developed each year to minimize incidental take of chinook during terminal area chum and coho fisheries.

Hatchery chum are released prior to the peak outmigration of chinook.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the NPPC *Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies. *(e.g. "The hatchery program will be operated consistent with the ESU-wide plan, with the exception of age class at release. Fish will be released as yearlings rather than as sub-yearlings as specified in the ESU-wide plan, to maximize smolt-to-adult survival rates given extremely low run sizes the past four years.").*

The chum program is operated consistent with the Puget Sound Salmon Management Plan and the Salmonid Disease Control Policy of the Co-managers.

3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates. *Indicate whether this HGMP is consistent with these plans and commitments, and explain any discrepancies.*

Puget Sound Salmon Management Plan, MOU with the Tulalip Tribe, Secretarial Order.

3.3) Relationship to harvest objectives.
Explain whether artificial production and harvest management have been integrated to provide as many benefits and as few biological risks as possible to the listed species. Reference any harvest plan that describes measures applied to integrate the program with harvest management.

The Stillaguamish watershed is managed for chum natural production, and harvest rates are established to meet natural escapement goals. Hatchery origin chum return to a tributary on the main stem below most of the chum spawning areas.

Incidental takes of chinook salmon during terminal coho fisheries are less than 50 fish annually and incidental takes of chinook during chum and steelhead fisheries are typically less than 28 fish for the most recent harvest seasons (Rawson, per.comm.).

3.3.1) Describe fisheries benefiting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available. *Also provide estimated future harvest rates on fish propagated by the program, and on listed fish that may be taken while harvesting program fish.*

Adult chum salmon from the program are caught primarily in Washington and Canada. The total harvest rates for the combined natural and hatchery population are as follows:

Year	Actual Harvest Rate
1986	41.9%
1987	73.3%
1988	60.1%
1989	83.3%
1990	68.7%
1991	80.1%
1992	58.0%
1993	81.9%
1994	29.9%
1995	42.9%
1996	13.4%
1997	35.0%
1998	10.6%
1999	23.6%

Source of data: Kit Rawson, Tulalip Tribes

3.4) Relationship to habitat protection and recovery strategies.

Describe the major factors affecting natural production (if known). Describe any habitat protection efforts, and expected natural production benefits over the short- and long-term. For Columbia Basin programs, use NPPC document 99-15, section II.C. as guidance in indicating program linkage with assumptions regarding habitat conditions

Chum salmon within the Stillaguamish watershed spawn in tributary habitat throughout most of the basin. Their extensive geographic range in both larger and smaller tributaries helps to buffer the population from the significant land use degradation that has occurred within the watershed.

Recovery plans being developed for ESA listed chinook are expected to also improve chum salmon freshwater survival as well.

Please see Section 3.4 of the Chinook Hatchery Genetic Management Plan for detailed habitat condition information.

3.5) Ecological interactions.

Describe salmonid and non-salmonid fishes or other species that could (1) negatively impact program; (2) be negatively impacted by program; (3) positively impact program; and (4) be positively impacted by program. Give most attention to interactions between listed and "candidate" salmonids and program fish.

Species that could negatively impact the chum program include most of the predators associated with eating salmon both as juveniles and as a adults. These may include: a). mammals such as seals, river otters, and orcas; b). birds such as mergansers, herons and cormorants; c). fish such as yearling coho, steelhead, cutthroat.

Species that may be negatively impacted by the program include other outmigrant salmonid species that are in the area during chum fry releases and the incidental take of other adult salmon species during the harvest of returning chum salmon.

Species that might positively impact the program are the kingfishers and herons that provide predator exposures to hatchery reared chum prior to release potentially increasing the survival of the remaining fish at release.

Species that are positively impacted by the program are all salmonid and non-salmonids that derive benefit both directly and indirectly from the marine derived nutrients that returning adult chum salmon distribute through out most of the basin.

SECTION 4. WATER SOURCE

4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

For integrated programs, identify any differences between hatchery water and source, and "natal" water used by the naturally spawning population. Also, describe any methods applied in the hatchery that affect water temperature regimes or quality. Include information on water withdrawal permits, National Pollutant Discharge Elimination System (NPDES) permits, and compliance with NMFS screening criteria

Incubation and early rearing water comes from a 60 foot deep well providing 150 gpm, while the main water supply is an intake structure in Harvey Creek. Water temperatures for the well range 48 to 50 F. Surface water temperatures range from 35 to 58 F and dissolved oxygen levels range from 8.2 to 14.1 ppm.

Flow rates:

Harvey Creek Hatchery
Incubation stacks 3 to 5 gpm per stack (well water)
Smaller circular tanks 45 to 65 gpm (surface)
Larger circular tanks 150 to 200 gpm (surface)

Jim Creek Egg Box and Rearing Pond: small un-named spring 30gpm.

The following water characterization data comes from Don Klopfer of the Stillaguamish Tribe's Natural Resources Department. Detailed chemical analysis of each source is available upon request.

Well/Spring Water characterizations

Harvey Creek Hatchery well water is a groundwater source with no known surface water influences. Harvey Creek Hatchery well water is soft water. Seasonal changes and characterizations for this water source have not been documented

Surface Water Characterizations

The North Fork Stillaguamish River at Whitehorse and Harvey/Armstrong Creek at the Harvey Creek Hatchery are predominately surface water sources with limited ground water influences. Both of the above surface water sources are characterized as very soft with limited mineral content. Seasonal variations are similar for both sources with the percentage of groundwater influence increasing during summer low flows.

Based on preliminary, conventional water quality data analysis, there are not significant chemical differences in any of these water sources for the purposes of fish rearing.

4.2) Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.
(e.g. "Hatchery intake screens conform with NMFS screening guidelines to minimize the risk of entrainment of juvenile listed fish.").

The Harvey Creek hatchery has 1/8-inch diameter circular perforated screen at its intake structure and currently meets Level One NPDES discharge standards for facilities rearing less than 10,000 pounds annual production.

The spring for the Jim Creek egg box has no fish and comes out of a pipe where screening is not needed.

All water used for the fish rearing facility is returned to receiving waters very close to where it was withdrawn.

SECTION 5. FACILITIES

Provide descriptions of the hatchery facilities that are to be included in this plan (see "Guidelines for Providing Responses" Item E), including dimensions of trapping, holding incubation, and rearing facilities. Indicate the fish life stage held or reared in each. Also describe any instance where operation of the hatchery facilities, or new construction, results in destruction or adverse modification of critical habitat designated for listed salmonid species.

5.1) Broodstock collection facilities (or methods).

Returning Harvey Creek hatchery chum are captured in a 12ft by 18ft by 4ft concrete pond where the fish are sorted by sex and ripeness.

Broodstock are captured in river by entanglement with a small mesh (4 in.) gill net. Once fish are removed from the net, they are transferred to 4ft.x 4ft. x 8 ft. soft mesh holding pens and then moved, using wet burlap bags to the fish transport truck.

5.2) Fish transportation equipment (description of pen, tank truck, or container used).

Transportation occurs in standard hatchery insulated fiberglass fish hauling truck. Maximum hauling numbers are 40 fish per 860 gallons of water. Compressed oxygen is provided during transport. Spare oxygen tanks are carried on the truck and oxygen flow to the tanks can be monitored from the cab while driving. Salt is added during transport as a therapeutic treatment. Hauling times do not exceed 2 hours from loading to unloading.

5.3) Broodstock holding and spawning facilities.

The Harvey Creek Hatchery has 6 discrete holding ponds for keeping broodstock separated by sex and for sorting ripe and unripe fish. Four 13 ft. diameter by 4 ft. deep circular tanks have a volume of 450 cubic feet and a flow of 45 to 65 gallons per minute. Two 20 ft. diameter by 4 ft. deep circular tanks have a volume of 940 cubic feet and a flow of 150 to 200 gallons per minute. Surface water from Harvey Creek is used for all circulars.

5.4) Incubation facilities.

Incubation occurs in vertical heath trays that are supplied with well water from a 65 foot deep well. Water flows from the well into a de-gas tower and then to a head box where individual valves control flow rates of 3 to 5 gallons per minute per 8 tray stack. Trays are double stacked and a second intake line adds additional water to the bottom eight trays

5.5) Rearing facilities.

Early rearing

Swim up fry are transferred to 4 shallow netart early rearing troughs that are 24 ft. long, 3.6 ft. wide and 1.5 ft. deep. Well water serves these troughs and ranges from 15 to 25 gallons per minute per trough. Fry are reared in these troughs for approximately 30 days and then transferred outside to above ground circular tanks. Beginning in 2003 new early rearing troughs will be installed which will double early rearing capacity.

Late rearing

Fish are reared at the Harvey Creek Hatchery in covered, dark brown circular tanks. These tanks provide continuous current, color and cover more representative of in-river holding pool habitat. Fish are more evenly distributed throughout the container and food tends act more like natural stream drift than in a conventional raceway.

5.6) Acclimation/release facilities.

Final acclimation occurs in the same circular fiberglass tanks used for late rearing.

5.7) Describe operational difficulties or disasters that led to significant fish mortality.

There have been periodic losses of significant numbers of eggs, swim up fry and pre-release fry due primarily to Saprolegnia, coagulated yolk and bacterial gill disease.

5.8) Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.
(e.g. "The hatchery will be staffed full-time, and equipped with a low-water alarm system to help prevent catastrophic fish loss resulting from water system failure.").

The Harvey Creek Hatchery has an extensive alarm system with triple flow sensors on the well and incubation/early rearing trough water system. The system was significantly up graded in 1997 after an alarm system failure that resulted in a significant loss of alevins for that broodyear. There are flow alarms on all gravity fed circular tanks with 2 central lines feeding each set of tanks. The alarm system includes a high water/flooding alarm to alert staff to possible flooding conditions. The hatchery is completely surrounded by a 6-foot high razor fence to restrict access. The main incubation well water pump has a double backup, with surface water being pumped by either a gasoline pump or the backup generator. Should the gravity feed water supply fail, the hatchery has multiple oxygen tanks, regulators and O2 stones to provide emergency oxygen until the flow problems can be resolved.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1) Source.
List all historical sources of broodstock for the program. Be specific (e.g., natural spawners from Bear Creek, fish returning to the Loon Creek Hatchery trap, etc.).

The founding populations for the Harvey Creek Chum program were wild fish caught on Squire Creek, Aston Creek and Jim Creek during the 1978-82 brood years. Periodic additions have occurred from these same sources.

Currently, the primary broodstock source is adult chum salmon returning to the fish trap

at Harvey Creek.

The SASSI stock status for Stillaguamish chum is defined as healthy.

The annual target for broodstocking is 300 adults.

6.2) Supporting information.

6.2.1) History.

Provide a brief narrative history of the broodstock sources. For listed natural populations, specify its status relative to critical and viable population thresholds (use section 2.2.2 if appropriate). For existing hatchery stocks, include information on how and when they were founded, sources of broodstock since founding, and any purposeful or inadvertent selection applied that changed characteristics of the founding broodstock.

See above information in Section 6.1.

6.2.2) Annual size.

Provide estimates of the proportion of the natural population that will be collected for broodstock. Specify number of each sex, or total number and sex ratio, if known. For broodstocks originating from natural populations, explain how their use will affect their population status relative to critical and viable thresholds.

The goal for broodstocking is 300 hatchery origin chum returning to the Harvey Creek Hatchery fish trap. Every year up to 20% , the broodstock would be captured from Squire Creek and Aston Creek to re-introduce wild origin genes to the hatchery population. The removal of 60 fish total from these three watersheds will not significantly impact the healthy status of the chum in these watersheds or the healthy status of chum throughout the Stillaguamish basin.

6.2.3) Past and proposed level of natural fish in broodstock.

If using an existing hatchery stock, include specific information on how many natural fish were incorporated into the broodstock annually.

During the 1978-82 period all broodstock were wild origin. Natural fish in the hatchery broodstock will not exceed 20% in any given year. Past use of natural broodstock has varied from 100% to less than 10%.

6.2.4) Genetic or ecological differences.

Describe any known genotypic, phenotypic, or behavioral differences between current or proposed hatchery stocks and natural stocks in the target area.

There are no known genetic or ecological differences between the natural spawnining population and the hatchery stock currently being used.

6.2.5) Reasons for choosing.

Describe any special traits or characteristics for which broodstock was selected.

The reason for choosing Squire Creek, Aston Creek and Jim Creek as the source for the hatchery chum program was not documented. These tributaries currently have significant runs of chum salmon returning to them.

6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.
(e.g. "*The risk of among population genetic diversity loss will be reduced by selecting the indigenous chinook salmon population for use as broodstock in the supplementation program*.").

Most broodstock will be captured in a hatchery fish trap on a lower mainstem tributary where there is no current usage by chinook. Periodic broodstocking on Squire, Aston and Jim Creeks will occur after chinook spawning has taken place.

SECTION 7. BROODSTOCK COLLECTION

7.1) Life-history stage to be collected (adults, eggs, or juveniles).

Only adult chum salmon will be collected.

7.2) Collection or sampling design.
Include information on the location, time, and method of capture (e.g. weir trap, beach seine, etc.) Describe capture efficiency and measures to reduce sources of bias that could lead to a non-representative sample of the desired broodstock source.

Returning adults are captured over the whole time period that fish enter the trap. Fish begin entering the trap in late October and continue returning until early January in some years. In most years, greater than 80% of the returning fish enter the trap with the remaining fish spawning below the trap. A few fish will migrate up the fish ladder when flow conditions in the creek are high enough.

7.3) Identity.
Describe method for identifying (a) target population if more than one population may be present; and (b) hatchery origin fish from naturally spawned fish.

Capture location is the key method used to identify the population to be spawned.

7.4) Proposed number to be collected:

7.4.1) Program goal (assuming 1:1 sex ratio for adults):

The program goal is to collect 300 adult chum for an estimated green egg take goal of 300,000.

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:

Year	Adults Females	Males	Jacks	Eggs	Juveniles
1988	425	450			
1989	37	37			
1990	251	260			
1991	25	25			
1992	140	169			
1993	43	43			
1994	245	245			
1995	225	225			
1996	350	350			
1997	30	30			
1998	488	473			
1999	282	282			

Data source: (Link to appended Excel spreadsheet using this structure. Include hyperlink to main database)

7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.
Describe procedures for remaining within programmed broodstock collection or allowable upstream hatchery fish escapement levels, including culling.

Excess females are stripped of eggs, which are then sold to an egg buyer. Carcasses are either given to tribal members and staff or donated to the local wild animal rehab center. Any carcasses left are placed back in tributaries for nutrient enhancement.

7.6) Fish transportation and holding methods.
Describe procedures for the transportation (if necessary) and holding of fish, especially

if captured unripe or as juveniles. Include length of time in transit and care before and during transit and holding, including application of anesthetics, salves, and antibiotics.

Transportation of chum occurs in standard hatchery insulated fiberglass fish hauling truck. Maximum hauling numbers are 60 fish per 860 gallons of water. Compressed oxygen is provided during transport. Spare oxygen tanks are carried on the truck and oxygen flow to the tanks can be monitored from the cab while driving. Salt is added during transport as a therapeutic treatment. Hauling times do not exceed 2 hours from loading to unloading.

Some of the chum that are captured in the trap are held in circular fiberglass tanks for one to two weeks until ripe.

7.7) Describe fish health maintenance and sanitation procedures applied.

Females are sampled for disease by pathology staff from the NWIFC. All broodstocking, transport, handling, and spawning equipment is disinfected with a solution of 100 ppm active iodine.

7.8) Disposition of carcasses.
Include information for spawned and unspawned carcasses, sale or other disposal methods, and use for stream reseeding.

Carcasses are either given to tribal members and staff or donated to the local wildlife rehab center. Any carcasses left, are returned to local tributaries for nutrient enhancement.

7.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.
(e.g. "The risk of fish disease amplification will be minimized by following Co-manager Fish Health Policy sanitation and fish health maintenance and monitoring guidelines").

Broodstocking, rearing and release of chum salmon will occur on a lower mainstem tributary that has no current chinook usage.

Releases of fry will occur prior to the peak outmigration period for natural chinook smolts.

The spawning, rearing and release of chum salmon will follow the guidelines in the Salmonid Disease Control Policy.

SECTION 8. MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

8.1) Selection method.

Specify how spawners are chosen (e.g. randomly over whole run, randomly from ripe fish on a certain day, selectively chosen, or prioritized based on hatchery or natural origin).

Fish in the trap and holding ponds are checked once a week for ripeness. All fish ready that day are killed and spawned.

8.2) Males.

Specify expected use of backup males, precocious males (jacks), and repeat spawners.

One primary male and one backup male are used for each two females.

8.3) Fertilization.

Describe spawning protocols applied, including the fertilization scheme used (such as equal sex ratios and 1:1 individual matings; equal sex ratios and pooled gametes; or factorial matings). Explain any fish health and sanitation procedures used for disease prevention.

Two females are placed in one bucket and then sperm from an individual male is mixed with the eggs. A different male is used for backup fertilization.

8.4) Cryopreserved gametes.

If used, describe number of donors, year of collection, number of times donors were used in the past, and expected and observed viability.

There is no cryopreservation.

8.5) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

(*e.g. "A factorial mating scheme will be applied to reduce the risk of loss of within population genetic diversity for the small chum salmon population that is the subject of this supplementation program".*).

There are no known adverse genetic or ecological effects to listed species from the chum spawning protocols used.

SECTION 9. INCUBATION AND REARING -

Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.

9.1) Incubation:

9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding.

Provide data for the most recent twelve years (1988-99), or for years dependable data are available.

Year	Estimate Green Egg Take	Survival to Ponding
1988	1, 232,616	80%
1989	110,000	93%
1990	503,177	81%
1991	50,000	90%
1992	350,000	95%
1993	91,500	80%
1994	646,000	70%
1995	450,000	90%
1996	900,000	92%
1997	90,000	65%
1998	1,200,000	96%
1999	760,000	70%

9.1.2) Cause for, and disposition of surplus egg takes.

Describe circumstances where extra eggs may be taken (e.g. as a safeguard against potential incubation losses), and the disposition of surplus fish safely carried through to the eyed eggs or fry stage to prevent accedence of programmed levels.

Surplus females are stripped of eggs and the eggs are sold to an egg buyer.

9.1.3) Loading densities applied during incubation.

Provide egg size data, standard incubator flows, standard loading per Heath tray (or other incubation density parameters).

Loading densities range from 6,000 to 8,000 chum eggs per tray. Flows range from 3 to 5 GPM. Chum eggs run approximately 1700 eggs per pound.

9.1.4) Incubation conditions.

Describe monitoring methods, temperature regimes, minimum dissolved oxygen criteria (influent/effluent), and silt management procedures (if applicable), and any other parameters monitored.

Incubation water is well water that is run through a packed column to add oxygen. Dissolved oxygen levels range between 10 and 11 ppm. Loading densities are within the standards currently used by most hatcheries. Silt management is not required unless surface water is used in an emergency where well water is not available. Well water

temperatures typically range between 49 and 50 F.

9.1.5) Ponding.
Describe degree of button up, cumulative temperature units, and mean length and weight (and distribution around the mean) at ponding. State dates of ponding, and whether swim up and ponding are volitional or forced.

Button up and ponding occurs when there issd little or no belly slit remaining on the majority of the alevins in a given incubator tray.

9.1.6) Fish health maintenance and monitoring.
Describe fungus control methods, disease monitoring and treatment procedures, incidence of yolk-sac malformation, and egg mortality removal methods.

Eggs are treated on an as needed basis with hydrogen peroxide at 500 ppm for 15 minutes or formalin at 1600 ppm for 15 minutes to control fungus development.

Coldwater disease and coagulated yolk are the primary problems seen at the hatchery. The problems are not consistently seen and typically do cause major losses of alevins and fry.

Non-viable eggs are removed at the eyed stage after shocking using a Jensorter Model WB-4 optical egg sorter. Remaining dead eggs are removed and counted at the time of ponding.

9.1.7) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.
(*e.g. "Eggs will be incubated using well water only to minimize the risk of catastrophic loss due to siltation.")*

Standard disease control guidelines are followed as recommended in the co-managers Salmonid Disease Control Policy.

9.2) <u>Rearing</u>:

9.2.1) Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1988-99), or for years dependable data are available.

BY	Green egg to ponding	Green egg to release	Comments
1988	0.8	0.79	
1989	0.93	0.91	
1990	0.81	0.7	
1991	0.9	0.8	
1992	0.95	0.94	
1993	0.8	0.72	
1994	0.7	0.64	pump failure and fungus problems
1995	0.9	0.88	
1996	0.92	0.9	
1997	0.65	0.41	environmental gill disease
1998	0.96	0.95	
1999	0.7	0.52	coldwater and bacterial gill diseases

9.2.2) Density and loading criteria (goals and actual levels).
Include density targets (lbs fish/gpm, lbs fish/ft3 rearing volume, etc).

Current early rearing densities exceed recommended targets by more than 100%. Beginning in 2003 the installation of new early rearing troughs will reduce densities to the recommended levels. The goal is to maintain all rearing and pre-release densities for flow below 1.2 lbs/GPM/inc and to maintain all rearing conditions for space below .25lbs/cubic ft./inch.

9.2.3) Fish rearing conditions
(Describe monitoring methods, temperature regimes, minimum dissolved oxygen, carbon dioxide, total gas pressure criteria (influent/effluent if available), and standard pond management procedures applied to rear fish).

Chum fry are transferred out to the 20 ft. diameter circular fiberglass tanks during February and March. Fish are monitored for growth typically twice a month and have fish health checks once per month until release. The fish are on Harvey Creek surface water and experience temperatures ranging between 38 F to 50F during their rearing time. Dissolved oxygen levels are monitored monthly at the hatchery intake. Tanks are cleaned on an as needed basis using a standard swimming pool type vacuum system.

9.2.4) Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.

Typically by February 15th chum fry are 1100/lb and 44mm; March 15th chum fry are 750/lb and 46mm; April 15th chum fry are 450/lb and 49mm; May 1st chum fry are 400/lb and 52mm.

9.2.5) Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.

Contrast fall and spring growth rates for yearling smolt programs. If available, indicate hepatosomatic index (liver weight/body weight) and body moisture content as an estimate of body fat concentration data collected during rearing.

This information is not available.

9.2.6) Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).

As swim up fry, fish are fed BioDiet Starter 7 times a day at approximately 4% B.W./day. At 700/lb, fry are fed BioDiet Starter 4 times a day at approximately 2.5% B.W./day. When fish reach 500/lb, they are fed BioMoist Feed 3 times a day at approximately 2.3% B.W./day.

9.2.7) Fish health monitoring, disease treatment, and sanitation procedures.

Each year, fish pathologists screen a representative number of adults returning to tribal hatcheries for pathogens that may be transmitted to the progeny. The exact number of fish to be tested from each stock is specified in the Co-managers Salmonid Control Policy. Pathologists work with hatchery crews to help avoid pre-spawning mortality of brood fish to maximize fertilization and egg survival.

Preventative care is also promoted through routine juvenile fish health monitoring. Pathologists conduct fish health exams at each of the tribal hatcheries on a monthly basis from the time juveniles swim-up until they are released as smolts. Monthly monitoring exams include an evaluation of rearing conditions as well as lethal sampling of small numbers of juvenile fish to assess the health status of the population and to detect pathogens of concern. Results are reported to hatchery managers along with any recommendations for improving or maintaining fish health. Vaccine produced by the TFHP may be used when appropriate to prevent the onset of two bacterial diseases (vibriosis or enteric redmouth disease). In the event of disease epizootics or elevated mortality in a stock, fish pathologists are available to diagnose problems and provide treatment recommendations. Pathologists work with hatchery crews to ensure the proper use of drugs and chemicals for treatment. The entire health history for each hatchery stock is maintained in a relational database called AquaDoc. (Northwest Indian Fisheries Commission Fish Pathology pers.comm.)

9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.

There is no smolt developmental indices data available for this stock.

9.2.9) Indicate the use of "natural" rearing methods as applied in the program.

Early rearing occurs in circular dark brown fiberglass tanks with covers over the top. The constant current and cover are more representative of in river pool habitat. Feed acts more like drift and fish distribute themselves out more evenly than in straight raceways. Nets are periodically removed to allow predator exposure to king fishers.

9.2.10) **Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.** (*e.g. "Fish will be reared to sub-yearling smolt size to mimic the natural fish emigration strategy and to minimize the risk of domestication effects that may be imparted through rearing to yearling size.")*

Hatchery operations will follow the Salmonid Disease Policy developed by the co-managers.

SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program. *Specify any management goals (e.g. number, size or age at release, population uniformity, residualization controls) that the hatchery is operating under for the hatchery stock in the appropriate sections below.*

10.1) Proposed fish release levels. *(Use standardized life stage definitions by species presented in **Attachment 2**. "Location" is watershed planted (e.g. "Elwha River").)*

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs				
Unfed Fry	50,000			Church and Jim Ck.
Fry	200,000	400 to 350	4/1 thru 5/10	Harvey Creek Hatchery
Fingerling				
Yearling				

10.2) Specific location(s) of proposed release(s).
Stream, river, or watercourse: Harvey/Armstrong Creek (WRIA 05.0126*)*

Release point: Harvey Creek Hatchery at river mile 3 on Harvey/Armstrong Creek
Major watershed: Stillaguamish River (WRIA 05)
Basin or Region: Puget Sound

10.3) Actual numbers and sizes of fish released by age class through the program.
*For existing programs, provide fish release number and size data for the past three fish generations, or approximately the past 12 years, if available. Use standardized life stage definitions by species presented in **Attachment 2**. Cite the data source for this information.*

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size
1988			57,600	400/lb				
1989			971,044	450/lb				
1990			99,832	388/lb				
1991			351,798	385/lb				
1992			40,000	400/lb				
1993			329,000	350/lb				
1994			66,000	371/lb				
1995			415,848	350/lb				
1996			395,863	350/lb				
1997			810,000	370/lb				
1998			36,700	300/lb				
1999			1,146,902	650/lb				
Average			393,382	397/lb				

Data source: (Link to appended Excel spreadsheet using this structure. Include hyperlink to main database)

10.4) Actual dates of release and description of release protocols.
Provide the recent five year release date ranges by life stage produced (mo/day/yr). Also indicate the rationale for choosing release dates, how fish are released (volitionally, forced, volitionally then forced) and any culling procedures applied for non-migrants.

During the 1995-99 period chum releases began as early as March 1st and were completed by May 8th. A matrix, which includes the number of fish on station, their size and the space available, determines release dates. During years where there are more fish on station, releases of chum begin earlier and at a smaller size in order to make room for the growth of the remaining fish.

Releases are a mix of both forced and volitional depending on whether space is needed for additional rearing.

10.5) Fish transportation procedures, if applicable.
Describe fish transportation procedures for off-station release. Include length of time in transit, fish loading densities, and temperature control and oxygenation methods.

There are limited transfers of eyed eggs to egg box programs. These occur in ice chest coolers. Transfers of fry occur in the hatchery tank truck and are less than an hour in length.

10.6) Acclimation procedures (*methods applied and length of time***).**

The majority of chum is released from circular tanks at Harvey Creek Hatchery.

10.7) Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

No marks are applied other than the incidental eolith/scale marks that occur from having fish incubated and early reared on constant temperature well water.

10.8) Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.

All fish reared are released.

10.9) Fish health certification procedures applied pre-release.

The standard Salmon Disease Control Policy guidelines are followed for pre-release fish health checks.

10.10) Emergency release procedures in response to flooding or water system failure.

Should emergency conditions arise that cannot be alleviated using the existing backup systems of pumps, compressed oxygen and fish transportation, then the fish would be released from their containers into the adjacent stream.

10.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.
(*e.g. "All yearling coho salmon will be released in early June in the lower mainstem of the Green River to minimize the likelihood for interaction, and adverse ecological effects, to listed natural chinook salmon juveniles, which rear in up-river areas and migrate seaward as sub-yearling smolts predominately in May").*

Chum releases occur prior to the peak outmigration of chinook smolts and the releases

are staggered over a month period to avoid a large concentration of fry outmigrating at any given time.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

This section describes how "Performance Indicators" listed in Section 1.10 will be monitored. Results of "Performance Indicator" monitoring will be evaluated annually and used to adaptively manage the hatchery program, as needed, to meet "Performance Standards".

11.1) Monitoring and evaluation of "Performance Indicators" presented in Section 1.10.

Please refer to Appendix A.

11.1.1) Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program.

Please refer to Appendix A.

11.1.2) **Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.**

Please refer to Appendix A.

11.2) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.
(*e.g. "The Wenatchee River smolt trap will be continuously monitored, and checked every eight hours, to minimize the duration of holding and risk of harm to listed spring chinook and steelhead that may be incidentally captured during the sockeye smolt emigration period.)"*

Please refer to Appendix A.

SECTION 12. RESEARCH

Provide the following information for any research programs conducted in ***direct association with the hatchery program described in this HGMP. Provide sufficient detail to allow for the independent assessment of the effects of the research program on listed fish****. If applicable, correlate with research indicated as needed in any ESU hatchery plan approved by the co-managers and NMFS. Attach a copy of any formal research proposal addressing activities covered in this section. Include estimated take levels for the research program with take levels provided for the associated hatchery program in* ***Table 1****.*

12.1) Objective or purpose.

Indicate why the research is needed, its benefit or effect on listed natural fish populations, and broad significance of the proposed project.

The Stillaguamish Chum Program is a production program and there is no research occurring with this stock at this location.

12.2) Cooperating and funding agencies.

12.3) Principle investigator or project supervisor and staff.

12.4) Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.

12.5) Techniques: include capture methods, drugs, samples collected, tags applied.

12.6) Dates or time period in which research activity occurs.

12.7) Care and maintenance of live fish or eggs, holding duration, transport methods.

12.8) Expected type and effects of take and potential for injury or mortality.

12.9) Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 1).

12.10) Alternative methods to achieve project objectives.

12.11) List species similar or related to the threatened species; provide number and causes of mortality related to this research project.

12.12) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.
(*e.g. "Listed coastal cutthroat trout sampled for the predation study will be collected in compliance with NMFS Electrofishing Guidelines to minimize the risk of injury or immediate mortality.").*

SECTION 13. ATTACHMENTS AND CITATIONS

Include all references cited in the HGMP. In particular, indicate hatchery databases used to provide data for each section. Include electronic links to the hatchery databases used (if feasible), or to the staff person responsible for maintaining the hatchery database referenced (indicate email address). Attach or cite (where commonly available) relevant reports that describe the hatchery operation and impacts on the listed species or its critical habitat. Include any EISs, EAs, Biological Assessments, benefit/risk assessments, or other analysis or plans that

provide pertinent background information to facilitate evaluation of the HGMP.

SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the foregoing information is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Certified by_____ Date:_____

Draft Document Under Development

Appendix A: Performance Standards, Indicators and Monitoring Tables

Program Goal:
Artificially propagated fish will provide education and fishing opportunities, while maintaining the abundance of an existing wild population.

Justification:
Benefits:
- Produce fish to meet educational program needs
- Maintain the total abundance of the composite natural/hatchery population.
-

Risk Avoidance:
- Produce adult hatchery fish that are similar to wild in life history traits
- Will maintain genetic diversity in the watershed and ESU

Sections 1.9 and 1.10. Table

Goal (Section 1.7-1.8)	**Performance Standard** (Section 1.9)	**Performance Indicator** (Section 1.10)
		1.
		2.
		3.
		4.
		5.
		6.
		7.
		8.
		9.
		10.
		11.
Maintain genetic diversity	The number of adults used for broodstock remains above the minimum effective population size.	12. Count the number of adults used for broodstock and note the size of the spawning matrix used.
	The NOR spawners in the hatchery broodstock remain at 20% percent.	13. Estimate the percent of NOR fish in the broodstock collected
	The hatchery production and practices do not alter the genetic characteristics of the NOR population.	14. Test the hypothesis that a genetic diversity index does not differ significantly between HOR and NOR recruits
		15.
Research Projects to evaluate the effectiveness of hatchery program(s)		16. Research project objectives

Sections 1.9 and 1.10. Table

Goal (Section 1.7-1.8)	**Performance Standard** (Section 1.9)	**Performance Indicator** (Section 1.10)
		1.
Result in an increasing trend of NOR that is estimated to be greater than would have been the case without the project.	The number NOR fish in the naturally spawning population increases in those tributaries that have been reseeded	2. Estimate the number of total NOR spawners in the tributaries that have been reseeded.
	The return per spawner for naturally spawning fish (NRR) remains above replacement level	3. Estimate the recruit per spawner for natural spawners

Section 11.1 Table. First column is taken from Table in section 1.9/1.10

Performance Indicator (Section 1.10)	**Methods/Comments** (Sections 11.1)
1. Determine that adequate numbers of hatchery spawners return to the hatchery that are similar to wild fish	Fish Tickets
2.	
3.	
4.	
5.	
6. Count the number of adults used for broodstock.	Hatchery monitoring plan
7. The age and sex composition of the broodstock collected for the hatchery does not differ significantly from the natural spawners	This requires random sampling of the broodstock as well as the naturally spawning population for age and sex.
8. Estimate the timing of the return of adults	This may be carried out using: • a weir • spawning ground surveys stratified over time Once an average spawning time distribution is established, the broodstock collection can be planned so as to distribute it over the range of the migration.
9.	
10. Test the hypothesis that the mean timing of outmigration of hatchery smolts is not significantly different from that of NOR produced smolts	This would require sampling of juveniles using a weir or trap to estimate the timing of the natural outmigration. This might be a short term project to estimate the mean and range of natural outmigration in order to determine the optimum time for hatchery release. Several years would be required to determine the variability of the timing and possibly to evaluate which environmental parameters, if any affect the timing.
11. Test the hypothesis that the mean timing of HOR returning adults is not significantly different from that of NOR returns	This would be affected by several means: • recording of number and type (HOR or NOR) of hatchery returns by time strata • recording of number and type (HOR or NOR) of returns to natural spawning areas by time strata, either in spawner surveys or at a weir.
12. Test the hypothesis that the proportional distribution of HOR spawners is the same as that of NOR	Spawning surveys that are stratified by area and time periods would be needed to collect the data needed for this indicator.
13. Count the number of adults used for broodstock.	Hatchery Monitoring plan
14. Estimate the percent of HOR fish in the broodstock collected	This will require a method to separate HOR from NOR returning adults e.g. a mass mark or a HOR tag group

Section 11.1 Table. First column is taken from Table in section 1.9/1.10

Performance Indicator (Section 1.10)	**Methods/Comments** (Sections 11.1)
15. Test the hypothesis that a genetic diversity index does not differ significantly between HOR and NOR recruits	This will require a genetic sampling plan of HOR and NOR returns.
16. Test the hypothesis that a genetic diversity index does not change significantly over time for NOR recruits	This will require a genetic sampling plan of HOR and NOR returns.
17. Research project objectives	Requires research plan for each project.

Section 11.1 Table. First column is taken from Table in section 1.9/1.10

Performance Indicator (Section 1.10)	**Methods/Comments** (Sections 11 and 12)
1. Estimate the number of total spawners	Estimation of total spawners can be carried out by several methods: • weirs • mark-recapture experiments • stratified surveys and expansions
2. Estimate the number of total NOR spawners	This also requires: • an estimate of the total spawning abundance and, • a method to separate HOR from NOR spawners e.g. a mass mark or HOR tag group.
3. Estimate the recruit per spawner for natural spawners	This estimate can be made if HOR and NOR returns are identified separately in all locations, i.e on the spawning grounds and in the hatchery. If the recruit per spawner is defined as all recruits to fisheries as well as escapement, then estimates of HOR and NOR fishery recoveries will be needed.
4. Estimate the proportion of HOR in natural spawning population	This will require marking the hatchery production and sampling the spawning population to recover the marks. The sampling should be distributed so that all spawners have an equal chance of being sampled for the mark.

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: _____ ESU/Population:_____ Activity:___			
Location of hatchery activity:_____ Dates of activity:_____ Hatchery program operato			
Type of Take	**Annual Take of Listed Fish By Life Stage *(Numbe***		
	Egg/Fry	Juvenile/Smolt	Adult
Observe or harass a)			50
Collect for transport b)			
Capture, handle, and release c)			
Capture, handle, tag/mark/tissue sample, and release d)			
Removal (e.g. broodstock) e)			
Intentional lethal take f)			
Unintentional lethal take g)			28
Other Take (specify) h)			

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

Instructions:

1. An entry for a fish to be taken should be in the take category that describes the greatest impact.
2. Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).
3. If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.